REMARKS

This is in response to the Official Action of July 25, 2006. Applicants have amended the claims in order to more precisely define the scope of the present invention, taking into consideration the outstanding Official Action.

Specifically, Applicants have amended claim 1 to recite that the universal heat spreader has an inner and outer surface, wherein the inner surface of the heat spreader faces the back surface of the semiconductor chip, and that the through holes in the universal heat spreader pass through the outer surface and the inner surface of the universal heat spreader. Claim 1 has also been amended to recite that heat is transferred from the inside of the thermal enhance semiconductor package to the outside of the thermal enhance semiconductor package. Finally, claim 1 has been amended to reword some of the claim language. Support for these amendments may be found throughout the specification as originally filed, including, e.g., Figure 3.

Claim 5 has been amended to incorporate the subject matter of claim 6, and therefore claim 6 has been canceled. Claim 9 has been amended to incorporate the subject matter of claim 10, and therefore claim 10 has been canceled.

Claims 4, 7, 8 and 11 have been amended in order to reword the limitations.

Claim 12 has been amended to recite that the adhesive is formed between the back surface of the semiconductor chip and the inner surface of the universal heat spreader, as shown in, e.g., Figure 3. Claim 15 has been amended to recite that an underfill is disposed between the upper surface of the carrier and the active surface of the semiconductor chip, as shown in, e.g., Figure 3.

Finally, new claims 24-30 have been added to the instant application. Claim 24 is similar to claim 1, and also recites that the disposing location of the heat transmission pins is adjustable to achieve the designed thermal resistance. Support for this claim may be found throughout the specification as originally filed, including, e.g, page 4, lines 3-5. New claims 25, 26, 27, 28, 29 and 30 are similar to original claims 4, 12, 13, 15, 16 and 17, respectively.

Turning now to the rejections set forth in the Official Action, the rejection of

claims 1, 12-14, 16 and 17 under 35 U.S.C. §102(e) as being anticipated by Tao (US Pat. No. 6,410,981) has been carefully considered but is most respectfully traversed in light of the amendments to the claims and the following comments.

The rejection of claims 1, 4-6, 12 and 16 under 35 U.S.C. §103(a) as being unpatentable over Nishiguchi (U.S. Pat. No. 5,525,548) in combination with Williams (US Pat. No. 6,730,998) has been carefully considered, but is most respectfully traversed in light of the amendments to the claims and the following comments.

Applicants wish to direct the Examiner's attention to the basic requirements of a prima facie case of obviousness as set forth in the MPEP § 2143. This section states that to establish a prima facie case of obviousness, three basic criteria first must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in Applicant's disclosure. In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Section 2143.03 states that all claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970). If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending therefrom is nonobvious. In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

Applicants also note MPEP §2143.01, which states in part that, if a proposed modification would render the prior art invention unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

Applicants also most respectfully direct the Examiner's attention to MPEP §

2144.08 (page 2100-114) wherein it is stated that Office personnel should consider all rebuttal argument and evidence presented by applicant and the citation of In re Soni for error in not considering evidence presented in the specification.

The Official Action urges that Nishiguchi discloses a thermal enhance semiconductor package as recited in claim 1 of the instant application, including a carrier 1, a semiconductor chip 6, bonding pads formed on the active surface of the semiconductor chip 6, a plurality of conductive devices b formed on the bonding pads and connecting the semiconductor chip 6 and the carrier 1, a universal heat spreader 4,3 disposed on the back surface of the chip 6, a plurality of heat dissipation pins 3 in the through holes of the heat spreader 4,3 and heat transmission adhesive s formed between the back surface of the chip 6 and the heat spreader 4,3. Applicants respectfully traverse these allegations for the following reasons.

To begin with, Applicants note that the Official Action alleges that elements 3 and 4 of the Nishiguchi reference read on the universal heat spreader of the presently claimed invention. In other words, despite Nishiguchi clearly showing in Figure 2 two separate elements (i.e., heat sink 3 and cap 4), the Official Action relies upon both elements combining to form a universal heat spreader as recited in the instant claims. Applicants also note that the Official Action urges that element 3 of the Nishiguchi reference reads on the heat transmission pins of the presently claimed invention.

It appears that the Official Action alleges that the heat sink 3 and cap 4 combine to read on the universal heat spreader recited in the instant claims such that the universal heat spreader 4,3 of Nishiguchi also reads on the limitation in claim 1 that the universal heat spreader be disposed on the back surface of the semiconductor chip. Because the cap 4 is not disposed on the back surface of the semiconductor chip (the cap 4 encases the semiconductor chip along with the carrier, but does not contact the chip), the Official Action includes the heat sink 3 as part of the alleged universal heat spreader, which does contact the back surface of the chip 6.

Given this interpretation, i.e., that elements 3 and 4 of Nishiguchi read on a universal heat spreader, Applicants respectfully submit that Nishiguchi fails to also

disclose heat transmission pins disposed in the through holes of the universal heat spreader as alleged in the Official Action. This is due to the fact that the Official Action cites element 3 both as part of the universal heat spreader and as a heat transmission pin. Applicants note that the claims of the instant application clearly set forth that the universal heat spreader and the heat transmission pins are separate items. This is perhaps most evident in the fact that, as recited in the claims, the heat transmission pins are disposed in the though holes of the universal heat spreader. Accordingly, under the Official Action's interpretation of the reference, the heat transmission pins 3 must be disposed into itself, i.e., into the universal heat spreader 4,3. Clearly this is an unreasonable interpretation of the reference.

In light of the fact that the claim language recites that the heat transmission pins are disposed through the universal heat spreader through holes and are therefore two separate elements, the Official Action may rely upon element 3 as either part of the universal heat spreader or as the heat transmission pins, but not both. And regardless of whether the Official Action relies upon element 3 as the universal heat spreader or as the heat dissipation pin, either interpretation means that reference fails to disclose an element of the claimed invention. If element 3 is a heat transmission pin, then the universal heat spreader 4 is not disposed on the back surface of the semiconductor chip. If element 3 is part of the universal heat spreader, then Nishiguchi fails to disclose heat transmission pins. In either interpretation of the reference, Nishiguchi fails to disclose the elements of the claimed invention as alleged in the Official Action, and is therefore incapable of properly supporting a §103(a) rejection according to the guidelines set forth in MPEP §2143.

Furthermore, Applicants respectfully submit that, contrary tot he assertion in the Official Action, Nishiguchi fails to disclose bonding pads as claimed in the instant application. The Official Action urges that the portion of the chip in contact with the ball b in Figure 10A is interpreted as a bonding pad. Applicants respectfully submit that such an interpretation is tantamount to ignoring the limitation all together. If Applicants intended for the bonding pad to simply be the portion of the semiconductor chip coming

into contact with the ball b, then Applicants would not have bothered with expressly claiming bonding pads. Each element recited in the claims adds structure to the claimed invention, and in claiming bonding pads, Applicants added to the structure of the package by reciting separate elements formed on the semiconductor chip. That separate bonding pads are part of the present invention is seen most clearly by examining, e.g., Figure 3, wherein bonding pads 323 are depicted. The bonding pads 323 are not merely areas on the semiconductor chip, but are separate elements formed on the semiconductor chip. Accordingly, Applicants respectfully submit that the interpretation set forth in the Official Action with respect to the bonding pads recited in the instant claims is wholly unreasonable and that Nishiguchi clearly fails to disclose bonding pads. Therefore, Applicants submit that Nishiguchi fails to properly establish a §103(a) rejection according to the guidelines set forth in MPEP §2143.

Regardless of the above comments with respect to the deficiencies of the §103(a) rejection over Nishiguchi and Williams, Applicants note that the amendments to the claims further differentiate the presently claimed invention from the cited references.

Specifically, and as discussed above, Applicants note that claim 1 of the instant application now recites that the heat spreader has an outer and inner surface wherein the inner surface faces the back surface of the semiconductor chip, and that the plurality of the through holes in the universal heat spreader pass through the outer and inner surface of the universal heat spreader. In light of this amendment, it is now clear that the through holes left empty to allow for air convection pass from the inside surface to the outside surface of the universal heat spreader.

The Official Action acknowledges that the Nishiguchi fails to disclose through holes in the universal heat spreader that provide air convection. In order to address this deficiency, the Official Action cites Williams, which allegedly utilizes holes in the heat spreader to allow for heat convection. However, as noted in the Advisory Action dated November 20, 2006, the holes for air convection in Williams are in the X direction, i.e., in a horizontal direction. Thus, incorporation of the air convention holes as taught in

Williams in the device of Nishiguchi would not result in air convention through holes that run through the inner surface and the outer surface of the universal heat spreader as recited in the presently amended claims. Amended claim 1 clearly establishes that the inner surface of the heat spreader faces the back surface of the semiconductor chip and therefore the through holes in the presently claimed invention run in the Y direction, i.e., vertically.

Accordingly, since the combination of Nishiguchi and Williams fails to disclose a air convention through hole that runs through the inner and outer surface of the universal heat spreader, Applicants respectfully submit that a proper §103(a) rejection according to the guidelines set forth in MPEP §2143 has not been established and the rejection should therefore be withdrawn.

Furthermore, as noted in the Request for Reconsideration filed October 23, 2006, the Nishiguchi reference cannot be modified by any teaching of vertical air convection through holes because a key aspect of Nishiguchi is the formation of a hermetic seal by the cap 4. Modifying Nishiguchi to have air convention through holes in the heat spreader 4,3 would destroy the hermetic seal and make the invention unsuitable for its intended use. Therefore, Applicants respectfully submit that Nishiguchi is fatally flawed as a primary reference of a §103(a) rejection.

In light of the above, Applicants respectfully request that the §103(a) rejection of claims 1, 4-6, 12 ans 16 over Nishiguchi and Williams be withdrawn.

The rejection of claims 7-11 under 35 U.S.C. §103(a) as being unpatentable over Nishiguchi in view of Williams as applied to claim 1 and further in combination with Ootsuki et al. (US Pat. No. 5,652,461), the rejection of claim 15 under 35 U.S.C. §103(a) as being unpatentable over Nishiguchi in view of Williams as applied to claim 1 and further in combination with Akram (US Pub. Pat. App. No. 2002/0185748), and the rejection of claim 17 under 35 U.S.C. §103(a) as being unpatentable over Nishiguchi in view of Williams as applied to claim 1 and further in combination with Chia et al. (US Pat. No. 5,933,710), have each been carefully considered but are most respectfully traversed in light of the following comments.

As indicated in the Official Action, each of the above rejections depends upon as its basis the rejection of claim 1 over Nishiguchi in view of Williams. However, as discussed in detail above, the rejection of claim 1 over Nishiguchi in view of Williams is deficient in several respects. Furthermore, Applicants respectfully submit that none of the secondary references cited above overcome all of these deficiencies. Therefore, as the above rejections depend on a deficient §103(a) rejection of claim 1, Applicants respectfully submit that each of the subsequent rejections depending on the base rejection of claim 1 is deficient for the same reasons. Accordingly, Applicants respectfully request that each of these rejections be withdrawn.

The rejection of claims 1 and 12-17 under 35 U.S.C. §103(a) as being unpatentable over Tao (US Pat. No. 6,410,981) in combination with Nishiguchi and Xu (US Pub. Pat. App. No. 2003/0143382) has been carefully considered but is most respectfully traversed in light of the following comments.

In summary, the Official Action urges that Tao discloses a thermal enhance semiconductor package generally meeting all of the limitations recited in claim 1 with the exception that Tao does not disclose heat transmission pins inserted into through holes in the universal heat spreader. However, the Official Action urges that based upon the teaching in Nishiguchi and Xu of heat transmission pins inserted in through holes, it would have been obvious to modify Tao to include heat transmission pins in the through holes in order to further increase heat dissipation by increasing surface area. Applicants respectfully traverse this proposed modification, as Tao clearly teaches away from such a modification and none of the cited references disclose the presence of both through holes for air convection and through holes for inserting heat dissipation pins.

Firstly, with respect to the assertion that Tao may be modified to include heat transmission pins in the through holes, Applicants respectfully submit that such a modification is improper for purposes of a §103 rejection because the modification would render Tao unsatisfactory for its intended purpose. Tao clearly states that vent 10 illustrated in Figure 7 is for allowing moisture to discharge out of the device disclosed

in Tao. Therefore, plugging the vents with the pins disclosed in Nishiguchi or fins disclosed in Xu as proposed in the Official Action would clearly render the Tao invention unsatisfactory for its intended purpose, since moisture would not be able to escape out of blocked vents 10. Therefore, the §103(a) rejection set forth in the Official Action fails to satisfy the requirements set forth in MPEP §2143 and should therefore be withdrawn.

Additionally, Applicants note that Nishiguchi discloses inserting heat transmission pins in every through hole of the heat spreader. To the contrary, the presently claimed invention is directed to inserting a heat transmission pin in some of the through holes in the heat spreader, but leaving some of the through holes open for air convection. Paragraph [0029] of Xu fails to disclose inserting heat transmission pins in through holes altogether. Ultimately, since neither of the secondary references suggest inserting heat transmission pins in only some of the through holes of a heat spreader, Applicants respectfully submit that the cited references fail to disclose or suggest the presently claimed invention.

The Advisory Action dated November 20, 2006 alleges that modifying Tao with the teaching of Nishiguchi would not destroy the invention of Tao because "pins that increase heat dissipation as indicated in the office action could be incorporated into the top middle portion of the invention of Tao... without obstructing the plurality of through holes (10 or12) permitting moisture release." However, Applicants note that there are no through holes located in the top middle of the device disclosed in Tao for heat transmission pins of the Nishiguchi to be placed in. Nishiguchi discloses heat transmission pins in through holes, but not the formation of through holes anywhere in a heat spreader followed by subsequent placement of heat transmission pins in the through holes. Accordingly, despite the Official Action's allegation that a through hole could be formed in the top middle of the device of Tao and a heat dissipation pin could be placed therein, there is no support or motivation in the references for such a modification.

The Advisory Action also urges that, despite Nishiguchi only disclosing forming heat dissipating pins in all of the through holes, the test for obviousness is what the

combined teachings of the references would have suggested to those of ordinary skill in the art and that Nishiguchi would have suggested a means to increase heat dissipation. Applicants note that these statements still fail to explain why one of ordinary skill in the art would be motivated by a teaching of heat dissipation pins being placed in all through holes to place heat dissipation pins in only some through holes. There must be some motivation supporting a departure from what is actually taught in the secondary reference and implementing it into the device of the primary reference. Applicants do not contend that the rejection fails because the secondary reference cannot be bodily incorporated into the structure of the primary reference, but rather point out that what is taught in the secondary reference, i.e., filling all through holes with heat dissipation pins to provide heat dissipation while forming a hermetic seal, is not what is being applied to the primary reference. Therefore, some additional motivation or support must be provided for why one of ordinary skill in the art would not only modify the invention of the primary reference, but also modify the teaching of the secondary reference. The Official Action has not provided such a motivation, and therefore a proper §103(a) rejection has not been established.

Accordingly, since neither Tao, Nishiguchi nor Xu, either standing alone or when taken in combination, disclose or suggest each and every element of the claimed invention, Applicants respectfully submit that a proper §103(a) rejection according to the guidelines set forth in MPEP §2143 has not been established and the rejection of claims 1 and 12-17 should therefore be withdrawn.

The rejection of claims 4-11 under 35 U.S.C. §103(a) as being unpatentable over Tao, Nishiguchi and Xu as applied to claim 1 and further in combination with Ootsuki has been carefully considered but is most respectfully traversed in light of the following comments.

As indicated in the Official Action, the above rejection depends upon as its basis the rejection of claim 1 over Tao in view of Nishiguchi and Xu. However, as discussed in detail above, the rejection of claim 1 over Tao in view of Nishiguchi and Xu is deficient. Furthermore, Applicants respectfully submit that the secondary reference

cited above does not overcome this deficiency. Therefore, as the above rejection depends on a deficient rejection of claim 1, Applicants respectfully submit that the subsequent rejection depending on the base rejection of claim 1 is deficient for the same reasons. Accordingly, Applicants respectfully request that this rejection be withdrawn.

In view of the above comments and amendments to the claims, favorable reconsideration and allowance of all of the claims now present in the application are most respectfully requested.

Respectfully submitted,
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